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(72) Inventors EBERHARD HOFMANN and ULRICH HOLTSCHMIDT

(54) BIOCIDAL PREPARATION

(71) We, TH. GOLDSCHMIDT A.G., a body corporate organised under the Laws of Germany, of 100 Goldschmidtstrasse, 43 Essen, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a biocidal preparation.

Recent and unpublished proposals disclose synergistic biocidal mixtures which contain a 2-alkylamino-6-aminopyridine as a bacteriologically active component, and either a quaternary ammonium compound or betaine as a second component.

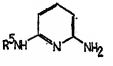
These previously proposed mixtures or preparations made therefrom exhibit excellent bacteriological characteristics, characteristics which are also pronounced in the presence of soaps, protein or lipoids. However, the cleaning action and foam-forming properties of preparations which contain quaternary ammonium compounds and 2-alkylamino-6-aminopyridines are not always satisfactory particularly if strongly soiled materials are to be cleaned. For this reason additional ingredients, such as, for example, non-ionic tensides have to be incorporated into the preparations so as to improve the cleaning and foaming actions.

In respect to preparations which contain betaines, it will be appreciated that mixtures of 2-alkylamino-6-aminopyridines and betaines are relatively expensive. This is so because the betaines, which in themselves are relatively inexpensive and which are used in the mixture as solubilizing agents, do not themselves possess any bacteriological activity. For this reason, higher concentrations of active component have to be used which thus render the preparations relatively expensive.

According to the present invention there is provided a synergistic biocidal mixture, comprising

a) a surface-active amine and/or surface-active aminoacid, and

b) a 2-alkylamino-6-aminopyridine of the general formula:



where R^5 is an alkyl radical containing from 8 to 18 carbon atoms or the radical

where X is a chlorine or bromine atom, the weight ratio of a:b being from 5:1 to 1:3.

It has surprisingly been found that the present mixtures, contrary to the individual components taken alone, exhibit superior biocidal activity and excellent cleaning action over a wide pH range. Further, the present mixtures or preparations comprising them have satisfactory compatibility in respect to the skin and mucous membranes and are substantially insensitive in respect to protein, lipoids and anionic detergents. Moreover, the present mixtures are economical both in respect to manufacture and use.

Concerning the surface-active amines which may be used in the present mixtures, compounds of the following formula I yield excellent results:

I

In this formula, R^1 is an alkyl radical containing from 8 to 18 carbon atoms, in which the carbon chain may be interrupted by —O—, —NH, or —CNH—;

R^2 is a hydrogen atom, or a $—CH_3$ or $—CH_2CH_2OH$ radical, and

R^3 is a hydrogen atom, or a $—CH_3$, $—CH_2CH_2OH$, $—(CH_2CH_2NR_2^2)$, $—(CH_2CH_2NR^2)_mR^2$ or $—(CH_2CH_2CH_2NR^2)_mR^2$

where m has a value of 1 or 2, and R^2 has the meaning just indicated.

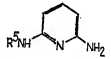
If a surface-active aminoacid is used, compounds of the general formula II are preferred:

II

where R^1 and R^2 have the above defined meanings, and R^4 is a

$—CH_2COOH$, $CH_3CHCOOH$, CH_3CHCH_2COOH, $—CH_2CH_2NHCH_2COOH$, $—CH_2CH_2NHCH_2CH_2NHCH_2COOH$, $—CH_2CH_2CH_2NHCH_2COOH$, $—CH_2CH_2NHCH_2CH_2NHCH(CH_3)COOH$ or $—CH_2CH_2CH_2NHCH(CH_3)CH_2COOH$ radical.

As indicated above, the 2-alkylamino-6-aminopyridines are compounds of the general formula III:



III

where R^5 is an alkyl radical containing from 8 to 18 carbon atoms or the radical

where X is a chlorine or bromine atom.

Surface-active amines corresponding to and embraced by formula I include, for example, laurylamine, N,N-bis-hydroxyethyl laurylamine, N-hydroxyethyl laurylamine, N,N-dimethyl laurylamine, N-laurylethylenediamine, N-lauryldiethylenetriamine, N-laurylpropylenediamine, N-lauryl-N′, N′-dimethylpropylenediamine and N-lauryldipropylenetriamine, as well as the analogous compounds which instead of the lauryl radical contain an octyl, decyl, tetradecyl, hexadecyl or octadecyl radical. Mixtures of such homologues are often particularly economical as they are, for example, formed in the production of surface-active amines from natural fatty acids, such as, for example, coconut fatty acids.

Surface-active aminoacids which can successfully be used in the present mixtures and are embraced by formula II, include, for example, N - laurylaminoacetic acid, N - laurylethylenediaminoacetic acid, N - lauryldiethylenetriaminoacetic acid, N - laurylpropylenediaminoacetic acid, N - lauryldiethylenetriamino - α - propionic acid and N - laurylpropylenediamino - β - butyric acid, as well as the homologous compounds wherein the lauryl radical is replaced by an octyl, decyl, tetradecyl, hexadecyl or octadecyl radical and mixtures thereof, for example, mixtures having alkyl radicals derived from a coconut fatty acid.

The compounds of formulae I and II are preferably employed in the form of a mixture of the two types of compounds. Such mixtures are, for example, obtained if compounds of formula I are reacted with chloroacetic acid, α-chloropropionic acid or crotonic acid in a mole ratio of >1:1. However, it is also feasible to employ the compounds of formulae I and II individually for the purpose of preparing the present preparations or mixtures which then additionally contain the 2-alkylamino-6-aminopyridine. However, in such a case, it should be observed that not all the compounds of formula I are sufficiently water-soluble at pH values of >7. Accordingly, if the compounds of formula I are used without formula II compounds, surface-active amines of sufficient water-solubility at the indicated pH, should be used, such as, for example, N-hydroxyethyl laurylamine, lauryldiethylenetriamine, laurylpropylenediamine, lauryldipropylenetriamine and N-lauryl-N′,N′-dimethylpropylenediamine.

Suitable 2 - alkylamino - 6 - aminopyridines for use in the present mixtures include 2 - octylamino - 6 - aminopyridine, 2 - decylamino - 6 - aminopyridine, 2 - laurylamino - 6 - aminopyridine, 2 - myristylamino - 6 - aminopyridine, 2 - stearylamino - 6 - aminopyridine, 2 - p - chlorobenzylamino - 6 - aminopyridine and 2 - o - chlorobenzylamino - 6 - aminopyridine.

The weight ratio of the compound(s) of formula I and/or II to the compound of formula III in the present mixtures or preparations is from 5:1 to 1:3, but is preferably from 3:1 to 1:2.

The manufacture of the present preparations or mixtures is accomplished in a simple manner, by simply mixing the individual com-

ponents *per se* or by mixing them in the form of their aqueous or alcoholic solutions at a temperature of from room temperature (20°C.) to 100°C. In addition to or instead of water and ethyl alcohol, the following solvents may be used: n-propyl alcohol, isopropyl alcohol, ethyl glycol, ethylene glycol, propylene glycol-(1,2), dioxane and glycol dimethylether. If desired, non-ionic tensides may be incorporated in the mixtures or preparations. The present mixtures or preparations may be produced in solid form, as pastes or in dissolved or dispersed form. The addition of inert carrier materials, such as thickeners, inorganic salts, such as alkali metal phosphates, alkali metal silicates, alkali metal borates or urea, as well as aroma-imparting compounds, is of course feasible.

The present preparations or mixtures may be used as disinfectants and preservatives in food processing plants, breweries, animal breeding establishments and hospitals. They are also effective algaecides, fungicides and viricides. In preparations containing the present mixture as the active ingredient, the concentration of the active ingredient is preferably from 0.001 to 0.5% by weight.

The invention will now be further described by several non-limiting Examples:

EXAMPLE 1

50 parts by weight of 2-octylamino-6-aminopyridine are dissolved in 100 cc. of alcohol while heating to 50°C. 200 parts by weight of an aqueous solution of 25% concentration are then added which solution contains as active component the reaction product of a mixture of 1 mole of N-lauryldiethylenetriamine and 2 mole of N-laurylpropylenediamine with 2 mole of chloroacetic acid. The pH value of the system thus obtained is adjusted to 4.5 by adding acetic acid. A clear foaming preparation is obtained containing about 28% of active ingredient. The preparation can be diluted with water in any desired ratio.

EXAMPLE 2

10 parts by weight of 2-octylamino-6-aminopyridine are dissolved in a mixture of 30 parts by weight of n-propanol and 10 parts by weight of glacial acetic acid. 50 parts by weight of a 20% aqueous solution containing as active ingredient the reaction product of 2 mole of N-laurylpropylenediamine and 1 mole of chloroacetic acid are then added. A clear, foaming solution is obtained which can be diluted with water in any desired ratio and which contains about 20% of active ingredient.

EXAMPLE 3

20 parts by weight of N-lauryl-N',N'-dimethylpropylenediamine, 10 parts by weight of 2-laurylamino-6-aminopyridine, 30 parts by weight of glacial acetic acid and 40 parts by weight of water are worked into a homogeneous preparation while heating to 60°C. The preparation contains 30% of active ingredient and can be diluted with water in any desired ratio. The preparation exhibits pronounced fungicidal activity.

EXAMPLE 4

50 parts by weight of N,N-bis-hydroxyethyl-laurylamine, 20 parts by weight of 2-chlorobenzylamino-6-aminopyridine, 30 parts by weight of concentrated hydrochloric acid, and 40 parts by weight of ethyl glycol are homogenized while heating to 50°C. The resulting solution contains 50% of active ingredient and can be diluted with water.

EXAMPLE 5

100 parts by weight of N-coconutalkyl-propylenediaminoacetic acid and 40 parts by weight of 2-decylamino-6-aminopyridine are dissolved in 300 parts by weight of propylene glycol-(1,2) with slight heating. The N-coconutalkyl-propylenediaminoacetic acid was obtained by the reaction of 1 mole of N-coconutalkyl-propylenediamine with 1 mole of chloroacetic acid. The chain length distribution in the coconutpropylenediamine is as follows:

C_8:	1.3%
C_{10}:	4.5%
C_{12}:	61.2%
C_{14}:	30.3%
C_{16}:	2.0%
C_{18}:	0.7%

After the addition of 120 parts by weight of acetic acid of 30% concentration, a clear foaming solution containing 25% of active ingredient is obtained.

EXAMPLE 6

In a manner analogous to that described in Example 5, a preparation is manufactured which instead of N-coconutalkyl-propylenediaminoacetic acid contains N-coconut alkylpropylenediamino-β-butyric acid. The latter was synthesized by the reaction of N-coconut-propylenediamine with crotonic acid.

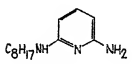
In order to demonstrate the synergistic effect of the present preparations, the bacteriological activity of the present mixtures or preparations was compared with that of the individual components of the mixtures.

The bacteriological tests were performed according to the "Richtlinien der deutschen Gesellschaft fuer Hygiene und Mikrobiologie (Guidelines of the German association for hygiene and microbiology)".

Test Series I

I a) Test of the preparation of Example 1:

The preparation consists of 1 part by weight of the reaction product of a mixture of 2 mole of $C_{12}H_{25}NH-(CH_2)_3-NH_2$ and 1 mole of $C_{12}H_{25}NH-(CH_2)_3-NH-(CH_2)_3-NH_2$ with 2 mole of chloroacetic acid and 1 part by weight of



This preparation is designated as preparation A.

The pH of a 0.1% solution of preparation A—calculated on the total amount of active ingredient—was adjusted to a value of 5.

Species	Concentration of active substance in % by weight	Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	±	−	−	−	−	−
	0.001	±	±	+	+	−	−
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	±	−	−	−	−
	0.005	+	+	±	+	−	−
	0.001	+	+	+	±	+	+
Proteus Vulgaris	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	±	−	−	−	−	−
	0.001	+	+	+	+	+	+
Escherichia coli	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	±	−	−	±	−	−
	0.001	±	±	+	±	±	±

− = no bacteria growth

± = bacteria growth

I b) Comparative control test:

The bacteriological activity of the reaction product of a mixture of 2 mole of $C_{12}H_{25}NH—(CH_2)_3—NH_2$ and 1 mole of $C_{12}H_{25}NH—(CH_2)_2—NH—(CH_2)_2—NH_2$ with 2 mole of chloroacetic acid was examined (hereinafter referred to as preparation B). The pH of a solution containing 0.1% of active ingredient was adjusted to a value of 5. This was effected with acetic acid.

Species	Concentration of active substance in % by weight	Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−
	0.05	+	−	−	−	−	−
	0.01	+	+	−	−	−	−
	0.005	+	+	+	−	−	−
	0.001	+	+	+	+	+	−
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	+	+	+	−	−	−
	0.005	+	+	+	+	−	−
	0.001	+	+	+	+	+	+
Proteus vulgaris	0.1	+	+	−	−	−	−
	0.05	+	+	−	−	−	−
	0.01	+	+	+	+	−	−
	0.005	+	+	+	+	−	−
	0.001	+	+	+	+	+	+
Escherichia coli	0.1	+	+	−	−	−	−
	0.05	+	+	−	−	−	−
	0.01	+	+	+	−	−	−
	0.005	+	+	+	+	−	−
	0.001	+	+	+	+	+	+

I c) Comparative control test:

The bacteriological activity of a dispersion of 2-octylamino-6-aminopyridine was tested (hereinafter referred to as preparation C).

The pH value of a 1% dispersion was adjusted to a value of 4.3 with acetic acid.

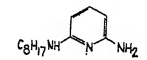
Species	Concentration of active substance in % by weight	Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−
	0.05	+	−	−	−	−	−
	0.01	−	−	±	−	−	−
	0.005	±	−	±	−	−	−
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−
	0.05	±	−	−	−	−	−
	0.01	−	±	−	−	−	−
	0.005	−	−	−	−	−	±
Proteus vulgaris	0.1	−	−	−	−	−	−
	0.05	+	−	−	−	−	−
	0.01	+	+	−	−	−	−
	0.005	−	±	±	+	−	−
Escherichia coli	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	+	−	−	−	−	−
	0.005	+	+	+	+	+	−

Comparison of the values of Tables *Ia* to *Ic* indicates clearly the superiority of the present synergistic mixture (preparation A) as compared with the individual components (preparations B and C).

Test Series II

II a) Test of the preparation of Example 2:

The preparation consists of 1 part by weight of the reaction product of 2 mole of $C_{18}H_{35}NH-(CH_2)_3-NH_2$ with 1 mole of chloroacetic acid and 1 part by weight of



This preparation is designated as preparation D.

The pH of an aqueous solution of preparation D containing 0.1% of active ingredient was adjusted with acetic acid to a value of 5.

Species	Concentration of active substance in % by weight	Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	+	+	−	−	−	−
	0.001	+	+	+	+	+	−
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	+	−	−	−	−	−
	0.001	+	+	+	+	+	+
Proteus vulgaris	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	+	−	−	−	−	−
	0.005	+	−	−	−	−	−
	0.001	+	+	+	+	+	+
Escherichia coli	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	−	−	−	−	−	−
	0.001	+	+	+	+	+	+

II b) Comparative control test:

The bacteriological activity of the reaction product of 2 mole of

$$C_{18}H_{33}NH—(CH_2)_3—NH_3$$

with 1 mole of chloroacetic acid was tested (preparation E).

The pH of a solution containing 0.1% of active ingredient was adjusted with acetic acid to a value of 5.

Species	Concentration of active substance in % by weight	Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−
	0.05	±	+	−	−	−	−
	0.01	±	+	−	−	−	−
	0.005	±	±	±	+	−	−
	0.001	±	+	+	+	+	±
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	±	−	−	−	−	−
	0.005	±	±	−	−	−	−
	0.001	+	+	+	+	+	+
Proteus vulgaris	0.1	±	±	±	−	−	−
	0.05	+	+	±	−	−	−
	0.01	±	±	±	+	−	−
	0.005	+	+	+	−	±	−
	0.001	+	+	+	±	+	+
Escherichia coli	0.1	+	+	+	−	−	−
	0.05	+	+	+	−	−	−
	0.01	+	+	+	+	−	−
	0.005	+	+	+	+	+	−
	0.001	+	+	+	±	+	+

A comparison of the values of Tables II *a* and II *b* indicates clearly the superiority of the present mixture as compared to the characteristics of the individual components.

Test Series III

In this test series, the bacteriological activity of the present preparations A and D, as well as of the control preparations B and E was tested in the presence of 20% by weight of bovine (cattle) serum. The tests were also performed pursuant to the Richtlinien der deutschen Gesellschaft fuer Hygiene und Mikrobiologie.

The pH of an aqueous solution containing 0.1% of active ingredient amounted to a value of 5.

III a) Bacteriological activity of the preparations A and D in the presence of 20% by weight of bovine serum.

Species	Concentration of active substance in % by weight	A Action time in minutes 1	2	5	10	20	30	D Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	−	−	−	−	−	−	−	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	−	−	−	−	−	+	−	−	−	−	−
	0.01	+	+	+	+	+	−	+	+	+	+	+	+
Proteus vulgaris	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	+	+	−	−	−	+	+	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Escherichia coli	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	−	−	−	−	−	−	+	−	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+

III b) Bacteriological activity of the control preparations B and E in the presence of 20% by weight of bovine serum.

Species	Concentration of active substance in % by weight	B Action time in minutes 1	2	5	10	20	30	E Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	+	−	−	−	−	−	+	+	−	−	−	−
	0.05	+	+	+	+	+	−	+	+	+	+	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−	+	−	−	−	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Proteus Vulgaris	0.1	+	+	+	−	−	−	+	+	+	+	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Escherichia coli	0.1	+	+	−	−	−	−	+	+	−	−	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+

Test Series IV

In this test series, the bacteriological activity of preparations A and D as well as the control preparations B and E was tested in the presence of 0.1% by weight of soft soap. The Richtlinien der deutschen Gesellschaft fuer Hygiene und Mikrobiologie were observed.

IV a) Bacteriological activity of preparations A and D in the presence of 0.1% by weight of soft soap.

Species	Concentration of active substance in % by weight	A Action time in minutes 1	2	5	10	20	30	D Action time in minutes 1	2	5	10	20	30
Staphylococcus aureus	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	+	+	−	−	−	+	+	+	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	−	−	−	−	−	−	−	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Proteus vulgaris	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	+	+	−	−	−	−	+	+	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Escherichia coli	0.1	−	−	−	−	−	−	−	−	−	−	−	−
	0.05	−	−	−	−	−	−	+	−	−	−	−	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+

IV b) Bacteriological activity of the control preparations B and E in the presence of 0.1% by weight of soft soap.

Species	Concentration of active substance % in by weight	B Action time in minutes 1	2	5	10	20	30	E Action time in minutes 1	2	5	10	20	30
Staphyloccocus aureus	0.1	+	+	−	−	−	−	+	+	−	−	−	−
	0.05	+	+	+	+	−	−	+	+	+	+	+	−
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Pseudomonas aeruginosa	0.1	−	−	−	−	−	−	+	−	−	−	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Proteus vulgaris	0.1	+	+	+	−	−	−	+	+	+	−	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+
Escherichia coli	0.1	+	+	+	−	−	−	+	+	+	−	−	−
	0.05	+	+	+	+	+	+	+	+	+	+	+	+
	0.01	+	+	+	+	+	+	+	+	+	+	+	+

A comparison of Tables IV *a* and IV *b* clearly indicates that the present preparations are rendered considerably less inactive by the presence of soft soap than the comparison or control preparations.

Test Series V

This test series examined the eye irritation caused by the present preparations and by the individual components thereof. The eye irritation test according to J. H. Draize and E. A. Kelley as described in Drug and Cosmetic Industry, volume 71 (1952) pages 36 and 37 and 118 to 120, was used for this purpose.

V a) The preparation used corresponded to preparation A, which contained, however, 0.5% by weight of active ingredient. The pH-value of this solution was 5.

Rabbit No.		1	2	3	4	5	Average Value
1st day	A	1	2	1	1	1	
	B	1	1	1	1	1	
	C	1	1	1	1	1	
		3×2=6	4×2=8	3×2=6	3×2=6	3×2=6	6.4
2nd day	A	1	1	1	1	1	
	B	0	1	0	0	0	
	C	0	0	1	0	0	
		2×1=2	2×2=4	2×2=4	2×1=2	2×1=2	2.8
3rd day	A	0	1	1	0	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	
		0	2×1=2	2×1=2	0	0	0.8
4th day	A	0	0	0	0	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	0

V b) The comparison preparation corresponded to preparation B, which contained, however, 0.5% by weight of active ingredient. The pH-value of the solution was 5.

Rabbit No.		1	2	3	4	5	Average Value
1st day	A	2	2	3	2	2	
	B	2	2	2	2	2	
	C	1	1	2	2	1	
		5×2=10	5×2=10	7×2=14	6×2=12	5×2=10	11.2
2nd Day	A	1	1	2	2	1	
	B	1	1	2	1	1	
	C	1	1	1	1	1	
		3×2=6	3×2=6	5×2=10	4×2=8	3×2=6	7.2
3rd day	A	1	1	1	1	1	
	B	0	0	1	1	0	
	C	0	1	1	0	0	
		2×1=2	2×2=4	3×2=6	2×2=4	2×1=2	3.6
4th day	A	0	1	1	1	0	
	B	0	0	1	0	0	
	C	0	0	0	0	0	
		0	2×1=2	2×2=4	1×2=2	0	1.6
7th day	A	0	0	0	0	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	0

V c) The preparation corresponded to preparation D, which contained, however, 0.5% by weight of active ingredient. The pH-value of the solution was 5. 5

Rabbit No.		1	2	3	4	5	Average Value
1st day	A	1	2	1	1	2	
	B	1	1	1	1	1	
	C	1	1	1	1	1	
		3×2=6	4×2=8	3×2=6	3×2=6	4×2=8	6.8
2nd day	A	1	1	1	1	1	
	B	1	1	0	1	1	
	C	0	1	1	0	0	
		2×2=4	3×2=6	2×2=4	2×2=4	2×2=4	4.4
3rd day	A	0	1	0	1	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	
		0	1×2=2	0	1×2=2	0	0.8
4th day	A	0	0	0	0	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	0

V d) The comparison preparation corresponded to preparation E, which contained however 0.5% by weight of active ingredient. The pH-value of the solution amounted to 5.

Rabbit No.		1	2	3	4	5	Average Value
1st day	A	3	2	2	3	2	
	B	2	2	2	2	2	
	C	2	1	2	2	1	
		7×2=14	5×2=10	6×2=12	7×2=14	5×2=10	12
2nd day	A	2	2	2	2	1	
	B	2	1	1	1	1	
	C	1	1	1	1	1	
		5×2=10	4×2=8	4×2=8	4×2=8	3×2=6	8
3rd day	A	1	1	1	1	1	
	B	1	1	0	1	0	
	C	1	0	1	0	0	
		3×2=6	2×2=4	2×2=4	2×2=4	1×2=2	4
4th day	A	1	1	1	1	0	
	B	1	0	0	0	0	
	C	0	0	0	0	0	
		2×2=4	1×2=2	1×2=2	1×2=2	0	2
7th day	A	0	0	0	0	0	
	B	0	0	0	0	0	
	C	0	0	0	0	0	0

The average value the numerical value of which is a measure of the irritation effect is significantly lower for preparations A and D than for the comparison preparations B and E. It follows that the present preparations cause considerably less irritation than the control preparations.

WHAT WE CLAIM IS:—

1. A synergistic biocidal mixture, comprising

a) a surface-active amine and/or surface-active aminoacid, and

b) a 2-alkylamino-6-aminopyridine of the general formula:

where R^2 is an alkyl radical containing from 8 to 18 carbon atoms or the radical

where X is a chlorine or bromine atom, the weight ratio of a: b being from 5: 1 to 1: 3.

2. A mixture as claimed in claim 1, wherein the weight ratio of a: b is from 3: 1 to 1: 2.

3. A mixture as claimed in claim 1 or 2, wherein the surface-active amine has the general formula

where R^1 is an alkyl radical containing from 8 to 18 carbon atoms, R^2 is a hydrogen atom, or a $-CH_3$ or $-CH_2CH_2OH$ radical, and R^3

is a hydrogen atom or a $-CH_3$, $-CH_2CH_2OH$, $-(CH_2CH_2NR_2^4)$, $-CH_2CH_2NR^2)_mR^2$ or $-(CH_2CH_2CH_2NR^2)_mR^2$ radical, where R^2 has the meaning just indicated and m is 1 or 2.

4. A mixture as claimed in claim 3, wherein the carbon chain of the alkyl radical R^1 is interrupted by —O—, —NH— or —CNH.

5. A mixture as claimed in any preceding claim, wherein the surface-active aminoacid has the general formula

where R^1 is an alkyl radical containing from 8 to 18 carbon atoms, R^2 is a hydrogen atom, or a $-CH_3$ or $-CH_2CH_2OH$ radical and R^4 is a

$-CH_2CH_2NHCH_2CH_2NHCH(CH_2)COOH$ or $-CH_2CH_2CH_2NHCH(CH_2)CH_2COOH$ radical.

6. A mixture as claimed in claim 5, wherein the carbon chain of the alkyl radical R^1 is interrupted by —O—, —NH— or —CNH—.

7. A synergistic biocidal mixture substantially as hereinbefore described in any one of the foregoing Examples.

8. A biocidal preparation containing as its active ingredient the synergistic mixture claimed in any preceding claim and containing an inert carrier.

9. A preparation as claimed in claim 8, wherein the inert carrier is water, n-propyl alcohol, isopropyl alcohol, ethyl glycol, ethylene glycol, propylene glycol-(1,2), dioxane or glycol dimethylether.

10. A preparation as claimed in claim 8 or 9, wherein the concentration of the active ingredient is from 0.001 to 0.5% by weight.

TREGEAR, THIEMANN & BLEACH,
Chartered Patent Agents,
Melbourne House,
Aldwych,
London, W.C.2.
Agents for the Applicants.

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